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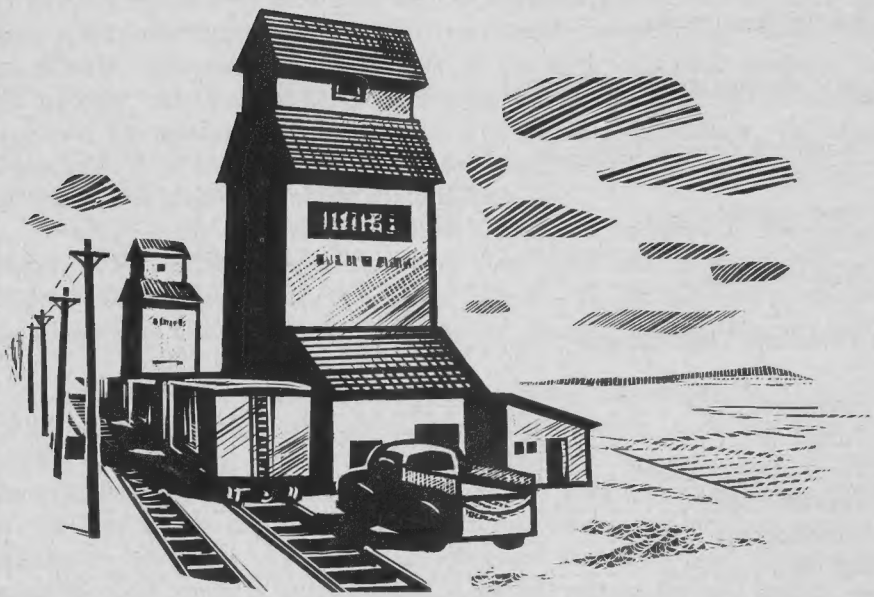
WINTER WHEAT PRODUCTION

In Western Canada



Research Station
Lethbridge, Alberta

CANADA DEPARTMENT OF AGRICULTURE

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WINTER WHEAT PRODUCTION IN WESTERN CANADA

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INTRODUCTION

Farmers have been growing winter wheat successfully in southern Alberta for over 60 years. They grow most of it in the southwestern corner of the province in an area bordered approximately by a line through Foremost and Taber on the east, and through Carmangay and Claresholm on the north; this area generally receives the greatest moderating effect from chinook winds. In Saskatchewan, winter wheat is grown successfully in a triangular area between Shaunavon, Val Marie, and Govenlock. It is possible to grow winter wheat in other areas of both provinces but with much greater danger of winterkilling.

Winter wheat produced in Western Canada is marketed in the Alberta Red Winter grades. Millers abroad use it for bread flour and, in export trade, it competes with American hard red winter wheats. In certain years, considerable quantities may find a market in Canada for cracker, cookie, biscuit, and pastry flour.

Growing winter wheat offers the farmer many advantages: (1) it usually outyields spring wheat (2) because of its earlier maturity, it suffers less from the critical droughts that usually occur during late June and early July (3) seeded in the fall, the crop eases the pressure of spring work and often saves one tillage of the land (4) it is usually cut about two weeks earlier than spring wheat, helping to spread the use of harvest labor and machinery over spring and winter crops (5) good stands of winter wheat in the fall protect the soil against wind and water erosion (6) winter wheat will usually compete more successfully with wild oats and certain other weeds than spring-sown crops.

But there are a number of hazards too. One of the more important of these is winterkilling. However, in the areas where winter wheat is best adapted, winterkilling has occurred less often than one year in ten. This hazard can be reduced considerably by using hardy varieties and proper cultural practices. Diseases and insect pests may cause severe losses, which may be reduced by proper control measures. Poor fall stands may result in wind damage and weed problems. Failure to use the proper cultural practices and other control measures for these hazards may result in complete loss of a crop.

The purpose of this bulletin is to discuss the known hazards of winter wheat production and how to reduce them.

VARIETIES

Two varieties of winter wheat, Kharkov 22 M.C. and Yogo are recommended for Alberta at present. New varieties may be developed or introduced from time to time. Consult your local agricultural extension service for latest recommendations.

Kharkov 22 M.C. — This variety is widely grown in Alberta and is the most winter hardy commercial variety available. It is awned, medium tall, more susceptible to lodging than most spring wheats, but more resistant to lodging than Yogo. It is moderately susceptible to shattering at maturity. It has no known resistance to diseases commonly occurring in Alberta or Saskatchewan. It is a good quality hard red winter wheat.

Yogo — It is only slightly less winter hardy than Kharkov 22 M.C., and has been the higher yielder of the two recommended varieties at Lethbridge from 1951 to 1958. It is the chief winter wheat grown in southwestern Saskatchewan and is becoming more popular in southern Alberta. It is awned, and has weaker straw but is more resistant to shattering than Kharkov 22 M.C. It is resistant to many races of common bunt, but not to dwarf bunt or other common diseases of winter wheat. It is a good quality hard red winter wheat.

Jones Fife (Velvet Chaff) — This awnless variety is *not* recommended because it is less winter hardy than the other two varieties and because its weak gluten makes it inferior as a hard red winter wheat. It has no known resistance to disease. Its straw strength is similar to that of Kharkov 22 M.C. and it is susceptible to shattering.

CULTURAL PRACTICES

Seedbed Preparation

On fallow, normal tillage with subsurface cultivators or oneway discs generally makes a satisfactory seedbed for winter wheat. Cultivate to kill all weeds and volunteer grain at least a week before seeding to help control wheat streak mosaic. Keep enough trash cover on the soil surface at all times to protect it against soil erosion. Where the soil is loose, rod-weed once or twice before seeding to pack the soil to produce a firm seedbed. Loose, cloddy soils tend to dry out and cause uneven germination, unthrifty seedling growth, and poor winter survival of the wheat plants.

It is possible to reseed stubble land to winter wheat if soil moisture is adequate for good germination and growth. Where winter wheat is to follow cereal grain or flax, use a straw cutter or spreader on the combine when harvesting the preceding crop. To prepare a seedbed on medium to light grain stubble, work with a oneway, disker, or cultivator followed by an oscillating harrow. On heavy stubble, two strokes with disk-type implements may be necessary to produce a bed in which a double-disk drill will operate properly. Mustard and rape do not leave heavy stubble, therefore after these crops only a light tillage with a

cultivator or blade is necessary to make a good seedbed for winter wheat.

Winter wheat sown on stubble may suffer less winter damage than when sown on fallow because of the protection from the snow held in the stubble. However, winter wheat seeded into wheat stubble may become more severely infected with root rot and streak mosaic than when seeded on fallow (see section on "Important Diseases and Their Control"). Cheat grass (downy brome) may infest winter wheat sown on stubble and even choke out the crop. It is difficult to eliminate from the growing crop.

Date of Seeding

Seed winter wheat during the first two weeks of September for best winter survival, highest yield, and best grade. At higher altitudes in the foothills where early frosts occur, seed during the first week of September. The bad effect on yield of earlier and later seeding is shown in Figure 1. Seeding before September increases chances of infection with root rot, wheat streak mosaic, and rust. Although plants from early seedings may be large enough to use as fall pasture they very often winterkill as is shown in Figure 2. Seeding after September 15 usually results in slow germination, patchy emergence, and too little top growth to prevent soil drifting. Plants from late seedings are more likely to winterkill than those seeded during the first two weeks of September.

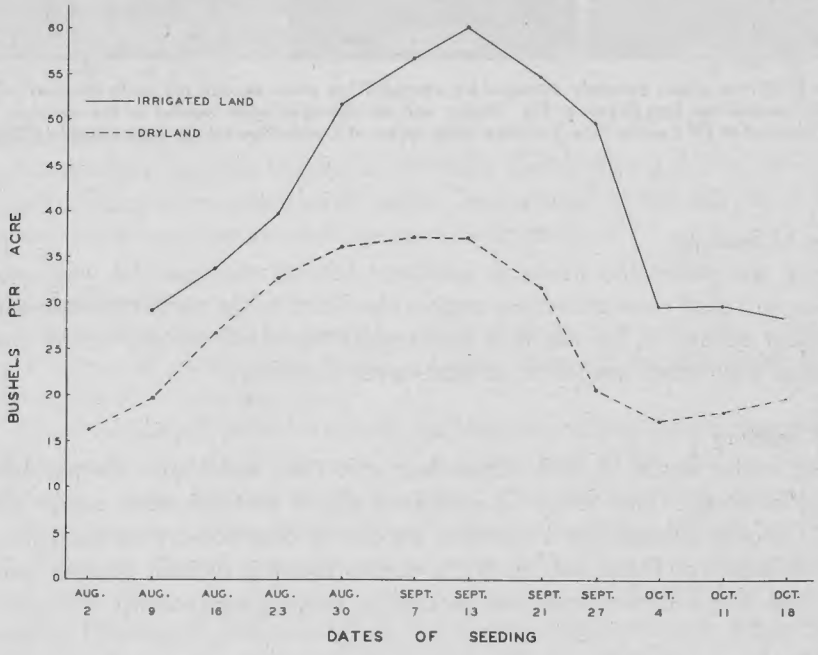

Figure 1. Effect of date of seeding on yield of Kharkov 22 M.C. winter wheat grown on dry land and on irrigated land, Lethbridge, Alberta, 1955 to 1958.

Figure 2. Winter wheat severely damaged by winterkilling when seeded too early (August 16) Left; seeded too late (October 11) Right; and not damaged when seeded at the optimum time (September 13) Centre. The 3 photos were taken at Lethbridge on the same date in 1956.

Direction of Seeding

Since the prevailing winds in southern Alberta are from the west, north–south rows will give most protection against the wind to the seedling wheat plants. Winter wheat seeded in furrows in a north–south direction usually ripens about a week earlier than when seeded in an east–west direction.

Depth of Seeding

Seed winter wheat 1½ to 2 inches deep into firm, moist soil. Deeper seeding will delay emergence and result in weakened plants that are more easily winterkilled. At depths of less than 1½ inches the soil is often too dry for good germination and emergence. Where soil is dry to depths below 2 inches, shallow seeding may be done with a furrow drill (see section on seeding equipment).

Rate of Seeding

Seed winter wheat at about the same rate as spring-sown wheat. In the Brown soil zone use 50 to 60 pounds of seed per acre. In the Dark Brown and Black soil zones, where moisture is more plentiful, use 60 to 70 pounds of seed per acre.

Seeding into Cover Crop

Yields of winter wheat are generally lower when the grain is seeded in a cereal cover crop than when seeded in well-prepared fallow, and especially so on eroded fine sandy loams that are low in fertility. However, if a cover crop is needed to control erosion or for fall pasture, it is best to use a cover crop of oats preceding winter wheat. Oats are better than wheat or barley as a cover crop because they reduce the yield of winter wheat less, and harbor fewer diseases injurious to winter wheat. An application of fertilizer when seeding the winter wheat will help overcome the yield-reducing effect of the cover crop.

Use of Fertilizers

Winter wheat will respond to applications of commercial fertilizers in much the same manner as spring wheat. Apply 30 to 40 pounds of nitrogen (N) per acre, when seeding winter wheat in cover crop or in stubble land if there is enough moisture. On eroded fine sandy loam soils in the Dark Brown soil zone apply 20 to 40 pounds of phosphorus (P_2O_5) per acre in addition to the nitrogen.

On fallow land, response to fertilizers has been extremely variable and depends on the location and cropping history of the soil. In the Dark Brown and Shallow Black soil zones, 10 to 20 pounds of nitrogen (N) plus 30 to 40 pounds of phosphorus (P_2O_5) per acre applied at seeding time has increased yields on eroded soils and soils low in fertility.

For annual changes in fertilizer recommendations consult your local agricultural extension agent.

Chemical Weed Control

Winter wheat may be treated in the early spring with 2,4-D or MCPA at the rates recommended for spring-sown grain. Do ***not*** treat in the fall, or in the late spring when the crop has reached the shot-blade stage.

Seeding Equipment

Winter wheat should be seeded in a firm, moist seedbed, and covered with 1½ to 2 inches of packed soil. Select a seeder that will do this under field condition that exists at seeding time.

The double-disk press drill can be used on fallow fields covered with a moderate trash cover (2,000 pounds or less per acre) if the soil is moist at the 2- to 3-inch depth. Seeding of winter wheat with a double-disk opener into dry soil often causes uneven germination, unthrifty seedling growth, and reduced yield. The hoe opener, arranged on a press wheel carriage to provide 7-inch spacing, will handle slightly more trash cover than the double-disk opener. The staggered, three-gang arrangement of the hoe openers provides trash clearance and a moderate furrow seeding action.

The furrow drill will do an excellent seeding job in a seedbed that is dry to a depth of about 4 inches. The staggered gang arrangement of the openers aids furrow formation and, hence, proper seed placement when soil is dry. The

furrow drill will seed through heavy trash cover (3,000 to 4,000 pounds per acre). The furrow ridges provide more protection from soil drifting than those left by a double-disk opener. Furrow drills should not be operated at high speed, for this may cover the seed with too much soil.

Two types of furrow drill are used for seeding winter wheat. The semi-deep-furrow drill equipped with hoe openers, lister-shovel openers, or large single-disk openers, has row spacings of 9 or 10 inches. The deep-furrow drill is usually equipped with wide lister-shovels but hoe, or large single-disk openers also have been used. Deep-furrow drills place the seed in 12- to 14-inch rows. Press wheels are used on furrow drills to maintain the shape of the furrow and to pack the soil over the seed. Yields of winter wheat seeded on fallow with three types of drills at Lethbridge, Alberta, from 1952 to 1958, averaged:

Type of Seed Drill	Yield
	Bu./acre
Semi-deep-furrow (hoe openers in 9" rows)	32.8
Deep-furrow (lister openers in 14" rows)	31.2
Double-disk press (7" rows)	30.6

The results of seven years of seeding trials at Lethbridge show some advantages from the use of the semi-deep- and the deep-furrow drills. Furrow seeding provided better stands than double-disk seeding under dry conditions in the fall of 1952 and 1953. In 1956 and 1957, less winterkilling occurred on furrow seeding than on double-disk seeding. There was not much difference in the results with the three types of seeders in the other years.

It is recommended that regular producers of winter wheat use one of the furrow drills. Farmers who occasionally grow winter wheat can use the double disk press drill with confidence if the seed bed is suitable.

IMPORTANT DISEASES AND THEIR CONTROL

Common Bunt

Common bunt is caused by fungi that are members of the smut family. These fungi are capable of infecting both winter and spring wheats.

Bunt spores, the "seeds" of the fungi, are carried on the surface of wheat kernels and are sometimes found on the soil. They germinate and penetrate the developing wheat seedlings. The fungus does not markedly affect the appearance of the immature wheat plant. However, as the plant matures, bunt balls filled with black spores replace the kernels in the heads. Many bunt balls are broken during threshing and the spores are scattered over the surface of the grain and on

soil. Heavily infected grain has an unpleasant fishy odor. These spores cannot live in the soil over winter.

Control common bunt by seed treatment, and by the use of resistant varieties.

Dwarf Bunt

Dwarf bunt is very similar to common bunt. However, the organism causing dwarf bunt will live in the soil for several years and it infects only fall-sown wheat. Plants with dwarf bunt are usually more stunted than those with common bunt. Seed treatment will not control dwarf bunt, but it will help prevent the spread of dwarf bunt spores from seed grain to non-infested soils.

To control the spread of dwarf bunt, treat seed with a product containing hexachlorobenzene. Grow crops other than winter wheat for three years where this disease is a problem. None of the varieties of winter wheat recommended at present for this area are resistant to dwarf bunt.

Common Root Rot

Fungi of common root rot may infect the plant throughout the growing season. Infected plants have a brown discoloration of the lower leaf sheaths, stem bases, crowns, and roots. They are reduced in height and have fewer tillers and kernels. Infection in the spring may arise from contaminated seed but much more frequently from spores in crop residues on the surface of the soil. Crops sown before September 1 are more subject to root rot. Losses from root rot are greater in hot dry weather.

To control root rot, grow resistant crops such as oats, flax, or legumes in the rotation. A two-year period without susceptible crops will eliminate much of the infection. Treat seed with a mercury fungicide and sow during the first two weeks of September.

Take-All Root Rot

The take-all root rot fungus lives in diseased crop refuse and attacks seedling wheat. The disease occurs in scattered plants or in patches in the Black and Dark Brown soils. Diseased plants are stunted and usually have white heads that are empty or contain only shrunken kernels. The roots are shiny black and so brittle that the plants are easily pulled up.

To control take-all, grow a resistant crop such as oats, or fallow the land for a year. Maintain soil fertility at a high level.

Wheat Streak Mosaic

Wheat streak mosaic is caused by a virus. Infected plants have light-green to yellow streaks on the leaves and are often severely stunted. In June, severely infected fields have a yellowish or bronze appearance, which is usually most severe on the west side. The wheat curl mite, which is extremely small, is carried by the wind and spreads the virus. Both mite and virus need a continuous supply of live plants, principally wheat, to survive.

To control the disease, destroy infected green wheat or barley a week or more before seeding. Winter wheat should not be sown beside a mosaic-infected crop until the crop matures. Seed between September 1 and September 15. Earlier sown wheat is much more prone to damage by the disease as shown in Figure 3. No resistant variety of wheat or suitable chemical control is available.

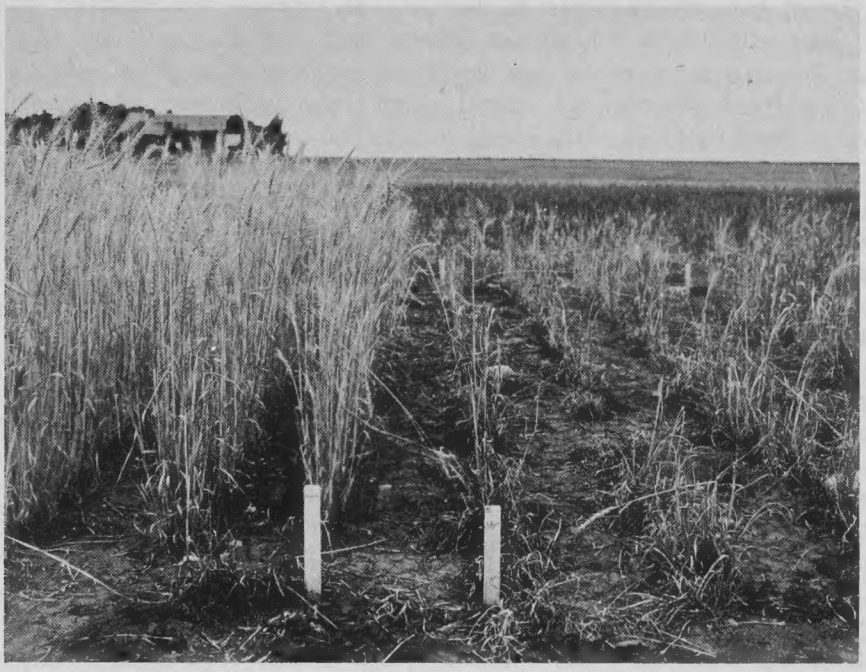

Figure 3. Relative streak mosaic damage in winter wheat seeded about September 1 (at left) and about August 1 (at right) adjacent to a wheat crop diseased with streak mosaic.

Rust

Winter wheat occasionally may be severely infected with leaf rust or stem rust or both. Infection may occur in the fall or during the summer. Crops sown early are more subject to rust infection in the fall than those sown late. On the other hand, crops sown late in the fall are more subject to rust infection in the summer than those sown early. Severe rust infection in the fall may weaken the plant. Rust is not known to survive the winter on wheat in this area. Rust seldom causes much damage to winter wheat in summer since the crop usually matures before the disease develops fully. Winter wheat on irrigated land usually has more rust infection than on dry land.

To reduce damage from rust, seed during the first two weeks of September. None of the varieties of winter wheat at present recommended for this area are resistant to stem or leaf rusts.

Seed Treatment

A good seed treatment first acts against the organisms on the surface of the seed that cause diseases such as bunt and common root rot, and second acts against the entry of harmful microorganisms into broken seed. Fungicides containing an organic mercury act in this manner; other fungicides are more selective in their action. Fungicides containing organic mercury are obtainable as liquids such as Panogen 15, or as powders such as Ceresan M. These fungicides, with lindane or aldrin added, will also give protection against wireworm injury.

Clean the seed before treating. Fungicides containing organic mercury are poisonous, so handle them with caution. Follow the manufacturer's directions precisely. Treat wheat at least 24 hours before sowing unless otherwise specified by the manufacturer. *Do not feed treated grain to livestock or sell it for other than seed.*

INSECT PESTS AND THEIR CONTROL

Wireworms

Wireworms move to lower soil depths in September. Therefore, if winter wheat is sown in early September, as recommended, it will usually be unnecessary to treat the seed for wireworm control. However, if wireworms are numerous, damage will occur in the spring. In this case treat the seed to reduce spring damage.

Cutworms

The pale western cutworm damages winter wheat less than spring-sown cereals because of the advanced growth of the winter wheat. Where an outbreak of pale western cutworm is forecast, do not work the land, nor seed during August and early September. This will reduce egg laying by the cutworm moths. Cutworms can be controlled with insecticides.

Wheat Stem Sawfly

In most years sawflies are not a serious problem in winter wheat. However, when the sawfly flight is early in relation to winter wheat growth, heavy damage may occur. Swath slightly on the green side to reduce losses from sawfly cutting. Grow a resistant spring wheat such as Rescue or Chinook for one or two years in heavily infested fields to reduce the sawfly hazard.

Hessian Fly

Serious damage by hessian fly in winter wheat occurred southwest of Lethbridge about 1916, but since then most of the occasional damage has been limited to spring wheat.

The eggs are laid in early May on the wheat leaves. The maggots work down below ground where they feed on the main shoot causing it to wilt and die. In June, the maggots change into a stage that resembles flax seeds. Some remain

in this stage until the following spring, others emerge as adult flies in July and reinfest the wheat plants at the second or third node. Here their feeding weakens the stems so that they break. Occasionally, damage from the first generation does not appear until near harvest time when the stem, weakened below ground, falls. The "flax seeds" at the base of the stem indicate the cause.

No control has been recommended for hessian fly in Western Canada. Fortunately serious damage has seldom occurred in the same fields for more than one or two years. When adequate moisture is present the tillers replace the main stem so that little loss of yield occurs.

Grasshoppers

Grasshoppers are attracted in the fall to new growth of winter wheat when other crops have matured. Thus a few grasshoppers per square yard can become a threat when concentrated along the edge of a winter wheat field. These mature grasshoppers eat more than small hoppers and require 1½ to 2 times the amount of insecticide to kill them.

It is preferable to kill the hoppers during the summer in their early stages but, unless this is done on a community basis, control in the fall may still be necessary. Apply insecticides before the wheat emerges where noticeable numbers of grasshoppers are present in adjacent fields and roadsides. If grasshoppers are moving into seedling wheat fields apply the insecticides to the area where they are feeding. Apply insecticides in the evening or early morning to the adjacent crop or stubble where the grasshoppers often shelter overnight.

Aphids

Although aphids often appear in large numbers on the heads of wheat in late summer, they can be safely ignored. Occasionally newly emerged winter wheat may become infested in the fall but, unless the aphids are extremely numerous, do not attempt chemical control. One species of aphid, the western wheat aphid, may severely stunt winter wheat by its attack in mid-June. Fortunately this aphid has been rare in Western Canada.

Note:

Since new insecticide recommendations appear frequently, they are not included in this bulletin. Obtain current recommendations for various insecticides from your local agricultural extension services.